

Cutaneous Malignant Melanoma in Hawaii – An Update

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In an examination of the descriptive epidemiology of cutaneous malignant melanoma in Hawaii for the period of 1960 through 1980, we identified 589 cases of invasive disease. On analysis, we found that the incidence of cutaneous malignant melanoma increased substantially among all age groups, both sexes and all anatomic sites in whites during the study period. In contrast, little change in incidence was found for nonwhites. Our findings are in agreement with the hypothesis that solar ultraviolet radiation is a causal factor for the occurrence of this condition among whites.

The incidence of cutaneous malignant melanoma has been increasing among white populations for at least the past three decades¹⁻⁷ and possibly longer.^{8,9} Although the cause of this dramatic increase is not yet certain, many investigators believe that increasing exposure of the skin to solar ultraviolet radiation plays the predominant role.^{2,5-10}

In an earlier review of cutaneous malignant melanoma in Hawaii,⁷ we reported that the age-adjusted incidence tripled in whites of both sexes between 1960 and 1977. Since that report, it has increased to even greater levels, as detailed herein. This continued increase prompted us to undertake a second epidemiologic analysis of cutaneous malignant melanoma in Hawaii in hopes that further light might be shed on its cause.

Methods

All case information regarding malignant melanoma of the skin was derived from the statewide, population-based Hawaii Tumor Registry, in operation since 1960 and a member of the SEER (Surveillance, Epidemiology and End Results) Program of the National Cancer Institute since 1973. All resident cases of malignant melanoma originating in the skin and diagnosed from 1960 through 1980 were identified, along with the diagnosis date, age, sex and ethnicity of patients. The anatomic location of the primary tumor was also identified.

Population estimates used in the calculation of incidence rates were determined for 1960 through 1970

from the decennial census with linear interpolation for intercensal years. For 1971 through 1980, population estimates were those provided by Dr. Thomas Burch of the Hawaii State Department of Health and were based on that department's ongoing Health Surveillance Program, which samples 2 percent of Hawaii households each year. Where age-adjusted rates are shown, the World Standard Population was used.¹¹ Although a number of cases of in situ cutaneous malignant melanoma were diagnosed during the study period, only invasive cases were included in the rate calculations so as to avoid an apparent rate increase that might be due only to increased screening and biopsy. Unfortunately, consistent pathologic criteria could not be applied in defining in situ cases, as pathology slides were often not available. Instead, in situ cases were defined as those so specified in the pathology reports abstracted by the Hawaii Tumor Registry.

Results

During the study period of 1960 through 1980, there were 645 cases of cutaneous malignant melanoma diagnosed among Hawaii residents. Of these, 589 (91.3 percent) were invasive at the time of diagnosis and the analyses that follow will be restricted to these invasive cases.

In all, 473 cases (80.3 percent) were diagnosed in whites and 116 (19.7 percent) in nonwhites. In comparison, whites constituted only 34.2 percent of the

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TABLE 1.—*Invasive Cutaneous Malignant Melanoma Among Hawaii Residents, 1960 Through 1980*

Age at Diagnosis	Number of Cases			
	Whites		Nonwhites	
	Male	Female	Male	Female
0-19	4	4	2	4
20-29	35	37	4	7
30-39	48	43	5	13
40-49	51	35	7	5
50-59	58	29	18	6
60-69	54	26	16	7
70-79	26	14	11	4
80+	5	4	4	3
TOTALS	281	192	67	49

TABLE 2.—*Invasive Cutaneous Malignant Melanoma Among White Residents of Hawaii by Time Period of Diagnosis and Sex*

When Diagnosed Years	Number of Cases		
	Male	Female	Total
1960-1962	9	6	15
1963-1965	20	12	32
1966-1968	16	20	36
1969-1971	29	20	49
1972-1974	43	25	68
1975-1977	72	41	113
1978-1980	92	68	160
1960-1980	281	192	473

state's population in 1970. A further distribution of these cases by age, sex and ethnicity is shown in Table 1. As can be seen, a large proportion of cases of cutaneous malignant melanoma was diagnosed among persons younger than age 40 (28.2 percent for all male patients and 44.8 percent for all female patients).

The frequency of the diagnosis of melanoma of the skin among whites increased steadily during the study period as shown in Table 2. The dramatic increase in the incidence of this condition among whites is shown in Figure 1. There appears to be no indication that this incidence rate is not continuing to increase. In definite contrast, the cutaneous malignant melanoma incidence among nonwhites remained almost stable during the same period (broader time groupings were used in calculating average annual rates among nonwhites because the small number of cases resulted in rate instability). The very high incidence of cases of invasive melanoma of the skin observed among whites in Hawaii during 1978 through 1980 (24.0 per 100,000 in men and 19.5 per 100,000 in women) is among the highest reported in the world.¹¹

As shown in Figures 2 and 3, the increase in incidence of cases of malignant melanoma over time is present among all age groups of whites. These data (plotted on semilog graphs) suggest no difference in the rate of increase among the age groups examined. It also can be noted in these figures that the incidence of cutaneous malignant melanoma among white men and women differs little up to age 54, but that rates in men are substantially higher for ages 55 and over.

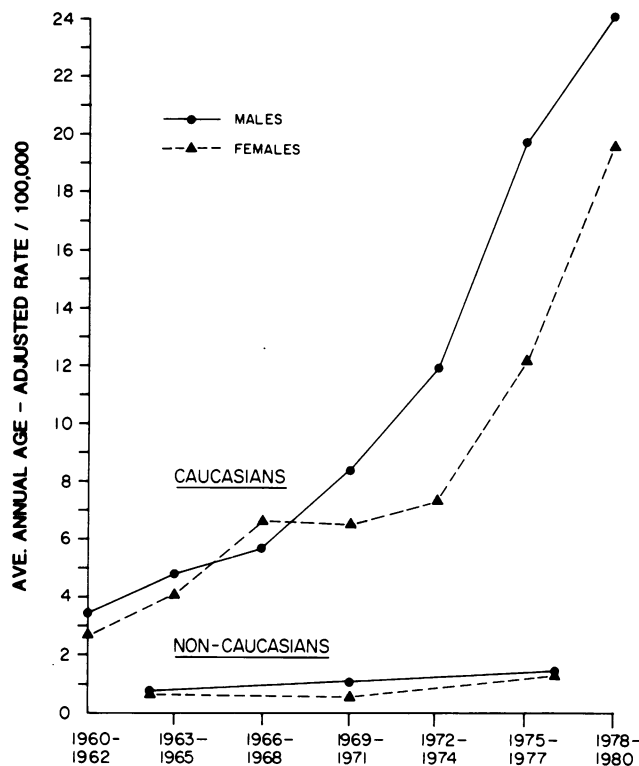


Figure 1.—Incidence rates of invasive cutaneous malignant melanoma among whites and nonwhites in Hawaii by sex and year of diagnosis, 1960 through 1980.

In Figures 4 and 5 the increase in cutaneous malignant melanoma incidence among whites is examined for various anatomic sites. The male/female differences in anatomic distribution of this condition are also apparent, with malignant melanoma of the skin of the head, neck and trunk more common in men and that of the lower extremities more common in women. A generally consistent increase in cutaneous malignant melanoma incidence for all four anatomic sites is seen for both sexes with the exception of that of the lower extremities. For this anatomic site, the incidence in men and women was curiously equal during 1972 through 1977, only to diverge in opposite directions in 1978 through 1980. Thus, cutaneous malignant melanoma of the lower extremities in men represents the only instance of decreasing rates in the most recent period.

The population in Hawaii consists of several ethnic groups, including Japanese (about 29 percent), Hawaiian/part-Hawaiian (about 18 percent), Filipino (about 11 percent), Chinese (about 5 percent) and others. As shown in Table 3, the average annual age-adjusted incidence of cutaneous malignant melanoma among these groups has not been very different during the study period. Moreover, each of these ethnic groups has shown only a tenth or less of the risk of malignant melanoma of the skin as that among whites. This risk differential by ethnicity has, of course, been increasing during the study period, as shown in Figure 1.

The effect of ethnicity on the risk of this condition

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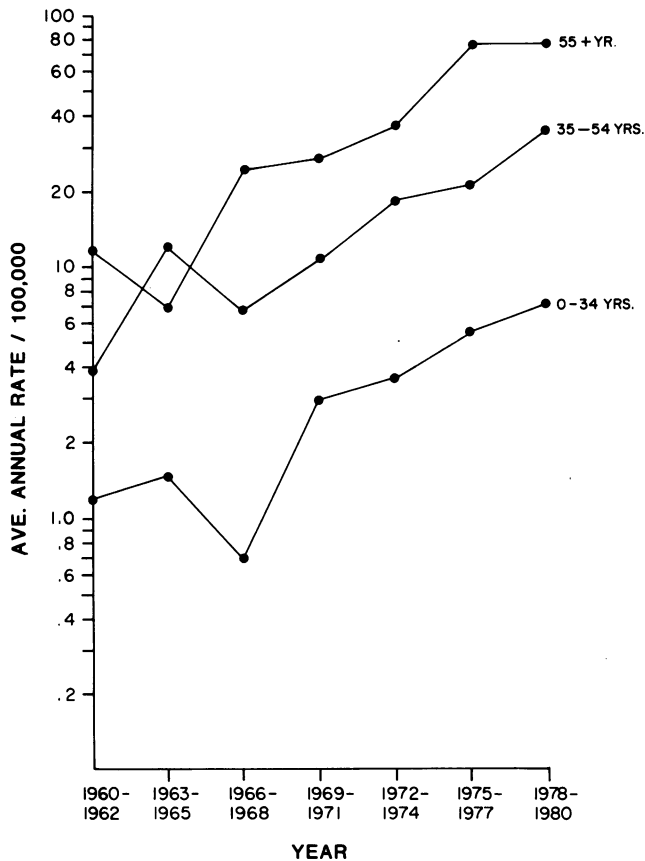


Figure 2.—Incidence of invasive cutaneous malignant melanoma by age among white men in Hawaii, 1960 through 1980.

developing is apparent in Hawaii even within the white group. About 10 percent of whites in Hawaii are of Portuguese ancestry as a result of large migrations of farm laborers from the Azores in the late 19th century. Exact population figures for the Portuguese population are not available, but cancer cases are coded for Portuguese ancestry by the Hawaii Tumor Registry, so that proportional cancer incidence during the study period could be estimated. Among Portuguese men, cutaneous malignant melanoma contributed only 0.5 percent of all cancer cases, and among Portuguese women, only 0.2 percent. In comparison, cutaneous malignant melanoma contributed 4.7 percent of all cancer cases among non-Portuguese white men and 3.1 percent among non-Portuguese white women.

Discussion

The outstanding observation of this report is the rapidly increasing incidence of cutaneous malignant melanoma among whites in Hawaii. This is a phenomenon that has consistently been reported among whites elsewhere in the United States,^{8,9} Scandinavia,^{1,2,4,9} England,⁵ Israel⁶ and Australia.³ The worldwide nature of the phenomenon leaves no doubt of its validity. Incidence rates in tropical areas such as Hawaii and Queensland, Australia,¹² are high enough to make melanoma of the skin one of the more common forms of cancer.

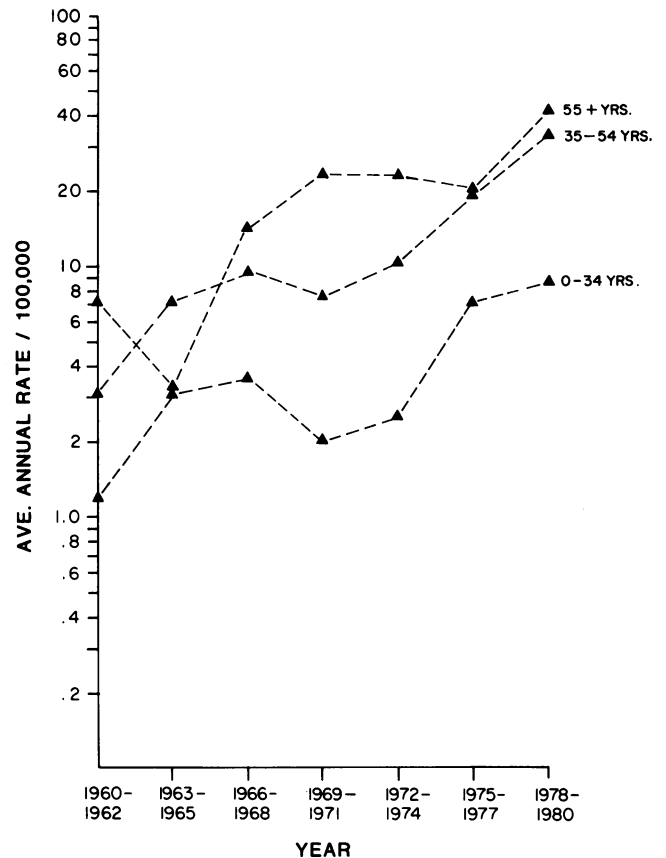


Figure 3.—Incidence of invasive cutaneous malignant melanoma by age among white women in Hawaii, 1960 through 1980.

In contrast to the rising rates of this malignancy among whites in Hawaii, there is little suggestion of increasing rates among nonwhites. Cutaneous malignant melanoma remains a very uncommon form of malignancy among all nonwhite groups in Hawaii.

If, as strongly suspected by many investigators, solar ultraviolet radiation plays the predominant role in causing malignant melanoma of the skin, then most of the descriptive epidemiology of the disease in Hawaii is understandable. The tropical location of Hawaii at 20°N latitude causes it to receive relatively high levels of solar ultraviolet radiation year-round.¹³ Accordingly, whites in Hawaii would be expected to have high rates of cutaneous malignant melanoma, as indeed they do. The incidence of this condition would probably be even higher were it not that a substantial proportion of Hawaii's white population is apparently resistant to melanoma because of Portuguese ancestry.¹⁴

The increase in the incidence of cutaneous malignant melanoma among whites in Hawaii during the past two decades, which is noted among all age groups, in both sexes and in all anatomic locations, is consistent with general observations and knowledge about secular changes in clothing styles and recreational patterns. (The only exception to this trend, that noted in male lower extremities, may simply be an anomaly produced by small numbers—only five cases contribute to the

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decreased rate in 1978 through 1980). The trend in Hawaii, as in most western countries, has clearly been toward more revealing clothing and beachwear and toward more leisure time spent in the sun. Sexual differences in clothing styles are reflected in the anatomic distribution of cutaneous malignant melanoma, with higher rates on the trunk for men (who often bare the complete trunk in contrast to women) and higher rates on the lower extremities of women. The higher rates of melanoma of the skin of the head and neck of men may reflect sexual differences in clothing styles (hats), hair-styles, hair loss, cosmetic use or outdoor work.¹⁵

The much lower melanoma incidence rate among all nonwhite groups almost certainly reflects the protection from solar radiation afforded these groups by their greater concentration of cutaneous melanin, which absorbs the ultraviolet energy before DNA damage occurs.

Widespread recognition of the probable causal association between solar radiation and cutaneous malignant melanoma by both health professionals and the general public is imperative if the alarming increase in the incidence of this malignancy is to be reversed. Recent investigations give reason to hope that such a reversal might be possible within a few years if solar exposure habits could be changed. An increased incidence of malignant melanoma has been shown to follow increased sunspot activity⁸ and hours of sunshine,⁵ with a lag time of two years or less. There is also evidence that a proportion of cases of cutaneous malignant mel-

noma may follow intense solar exposure by an even shorter period, as suggested by summertime peaks in diagnosis.^{4,16,17}

Professional and administrative workers, clerks and salespersons have a higher incidence of cutaneous melanoma than manual and unskilled workers, suggesting that intermittent leisure-time exposure increases risk.¹⁸ Support for this concept is also forthcoming from analysis of the occupational patterns of cutaneous malignant melanoma for different anatomic sites. Office work is associated with a large excess of melanoma of the trunk and limbs, whereas outdoor work is associated with an excess of melanoma on the skin of the head and neck.¹⁵ A cohort analysis of 5,108 cases of cutane-

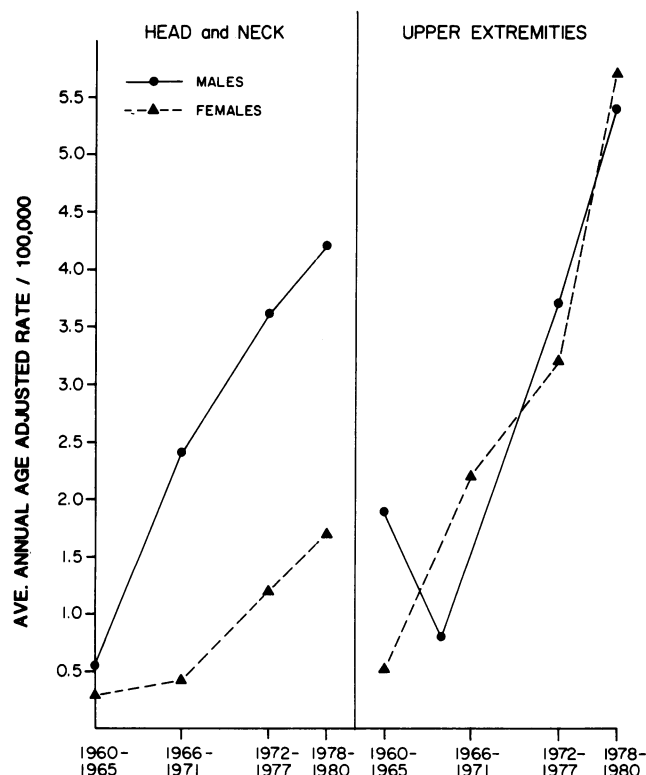


Figure 4.—Incidence of invasive cutaneous malignant melanoma of the head and neck and upper extremities among whites in Hawaii, 1960 through 1980.

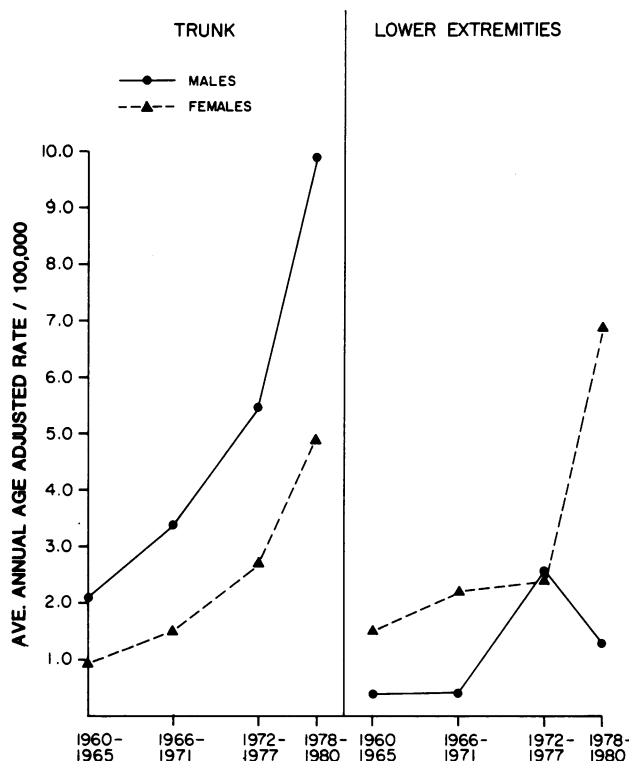


Figure 5.—Comparison of incidence of invasive cutaneous malignant melanoma of the trunk and lower extremities among whites in Hawaii, 1960 through 1980.

TABLE 3.—Average Annual Age-Adjusted Incidence of Cutaneous Malignant Melanoma Among White and Nonwhite Ethnic Groups in Hawaii, 1960 Through 1980

Ethnic Group	Number of Cases*	Rate in Both Sexes
Whites	473	10.4 per 100,000†
Hawaiians/part-Hawaiians	22	1.1 per 100,000
Filipinos	15	0.9 per 100,000
Chinese	8	0.9 per 100,000
Japanese	35	0.7 per 100,000

*The remaining 36 cases in nonwhites either could not be assigned to a specific ethnic group because of racial admixture not involving Hawaiian stock, or belonged to one of the less-populous ethnic groups (Korean, Samoan, Vietnamese, black).

†In comparison, the same rate among whites living in areas of the United States covered by the Third National Cancer Survey in 1969 through 1971 was only 4.1 per 100,000.²⁰

ous malignant melanoma in Norway has found a leveling off of age-specific incidence curves for the trunk and lower limbs at older ages within cohorts.² This could be explained by a lessened tendency with age to overexpose one's skin to the sun, resulting from experience, changed recreational habits or reduced peer pressure. This explanation would also suggest that changes in sun-exposure habits may affect the risk of cutaneous malignant melanoma developing rather rapidly.

Some experimental evidence suggests that exposure to ultraviolet light may increase the rate of melanoma growth either directly or indirectly.¹⁰ Such an influence on the growth rates of latent melanoma cells might be an explanation for the association of cutaneous melanoma incidence with sunspot activity⁸ and increased summer solar radiation.^{4,16,17}

Given the body of evidence now available, there seems little reason to doubt that solar ultraviolet radiation exposure contributes significantly to the risk of cutaneous malignant melanoma in whites. However, there are notable inconsistencies in the evidence, in particular the anatomic distribution of lesions. Among white men in Hawaii, the incidence of melanoma is higher on the trunk than either the head and neck or upper extremities, though the trunk is certainly more often covered. Among white women, the incidence of cutaneous malignant melanoma is about equal for the trunk and upper extremities and much lower for the head and neck. Such observations might be explainable, however, if we possessed more knowledge of the role played by such factors as body hair, shaving and cosmetics in the risk resulting from solar exposure.

We also must not ignore the possible contribution of nonsolar factors to the risk of cutaneous malignant melanoma developing.¹⁹ Genetic predisposition clearly plays a role, and dietary factors (particularly retinoids), trauma, hormonal factors, occupational exposures, viruses and certain drugs may also influence risk. However, it is difficult to imagine any hypothesis incorporat-

ing these nonsolar factors that could explain the astounding increase in cutaneous malignant melanoma incidence among whites during the past few decades, particularly in view of the lack of a similar increase among other ethnic groups. Accordingly, it seems probable that modification of solar exposure patterns is currently the most reasonable approach to reducing risk among whites.

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